Starter

Complete Exercise 1.1 on the probability worksheet

M Probability

M1

Understand and use mutually exclusive and independent events when calculating probabilities.

Link to discrete and continuous distributions.

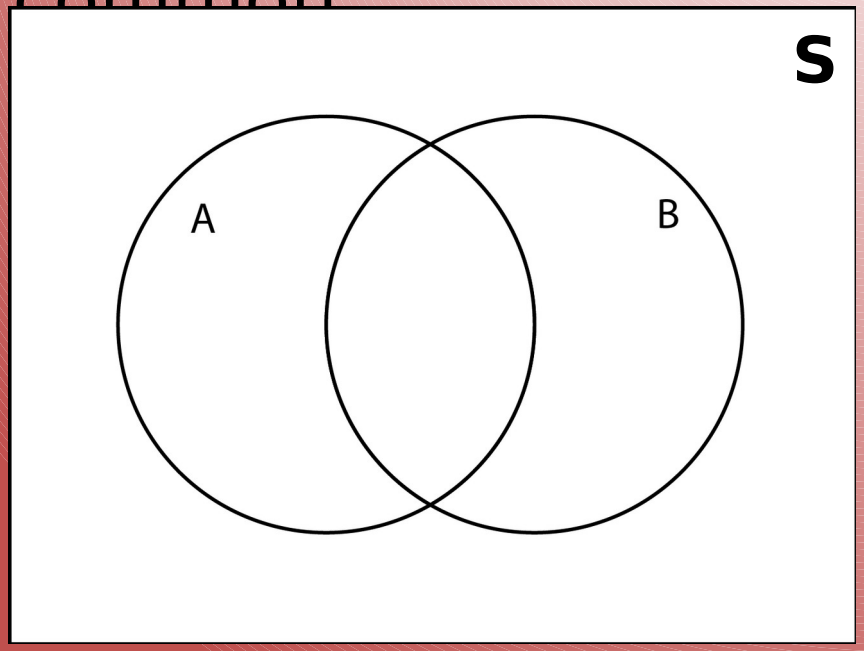
Students should be able to:

- find the probability of an event by extracting relevant information from a description of a situation (in context) or from a table of information
- recognise and use set theory notation in the context of probability, eg $\mathrm{P}(A \cup B)$, $\mathrm{P}(A \cap B)$, $\mathrm{P}(A')$
- recognise and define the meaning of mutually exclusive events, i.e. $\mathrm{P}(A \cap B) = 0$
- understand that $A \cup B$ means A or B and that, in probability, "or" is interpreted as an inclusive or, not as an exclusive or
- define the condition for two events to be independent and determine whether two events are independent by finding, and comparing, relevant probabilities, eg $\mathrm{P}(A \cap B) = \mathrm{P}(A) \times \mathrm{P}(B)$ or $\mathrm{P}(A) = \mathrm{P}(A \mid B)$, when the events A and B are independent (not required at AS).

10.1 Probability

Venn Diagrams

A **Venn diagram** shows how a collection of **objects** is split up into different **groups** where everything in a group has something in common.



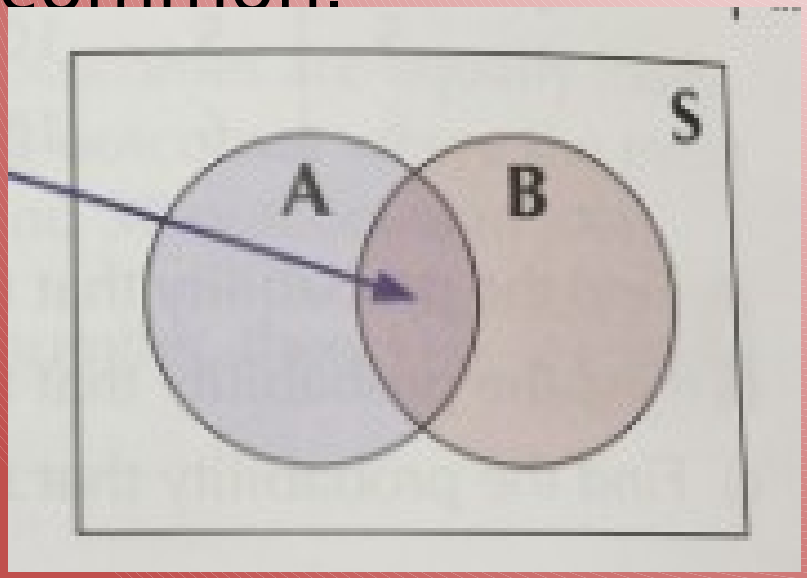
S is the set of all possible **outcomes**, the **total probability** in S equals **1**.

Circle A (and circle B) represent all **outcomes** corresponding to **event A** (and event B).

10.1 Probability

Venn Diagrams

A **Venn diagram** shows how a collection of **objects** is split up into different **groups** where everything in a group has something in common.



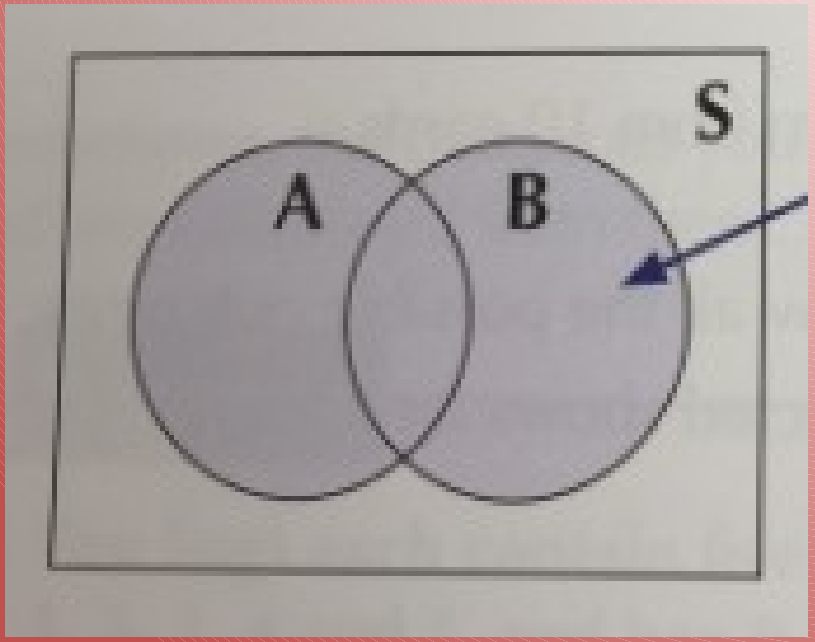
The area where the circles **overlap** represents all the outcomes corresponding to **both** event A **AND** event B happening.

This is called the **intersection**

10.1 Probability

Venn Diagrams

A **Venn diagram** shows how a collection of **objects** is split up into different **groups** where everything in a group has something in

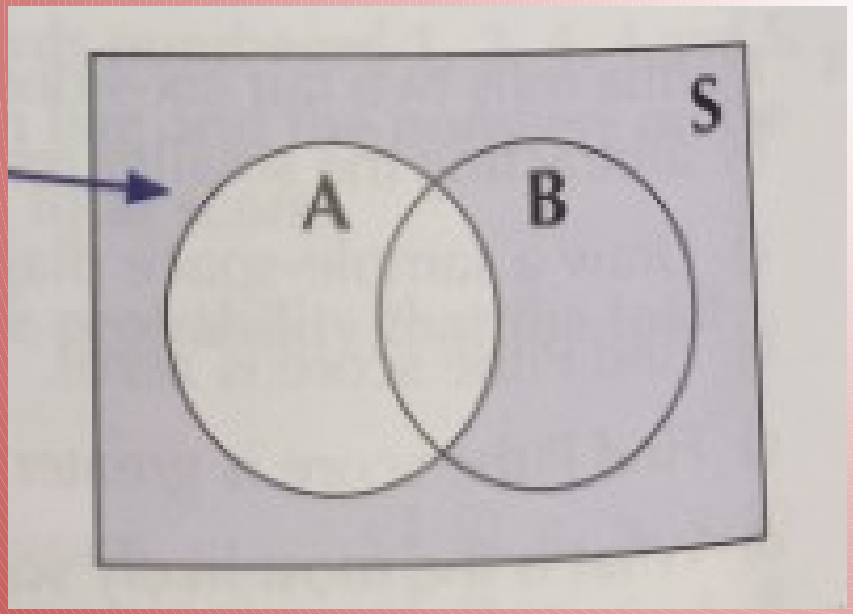


The shaded area represents all the outcomes corresponding to **either** event A **OR** event B happening (or **both**).

This is called the **union**.

10.1 Probability

Venn Diagrams

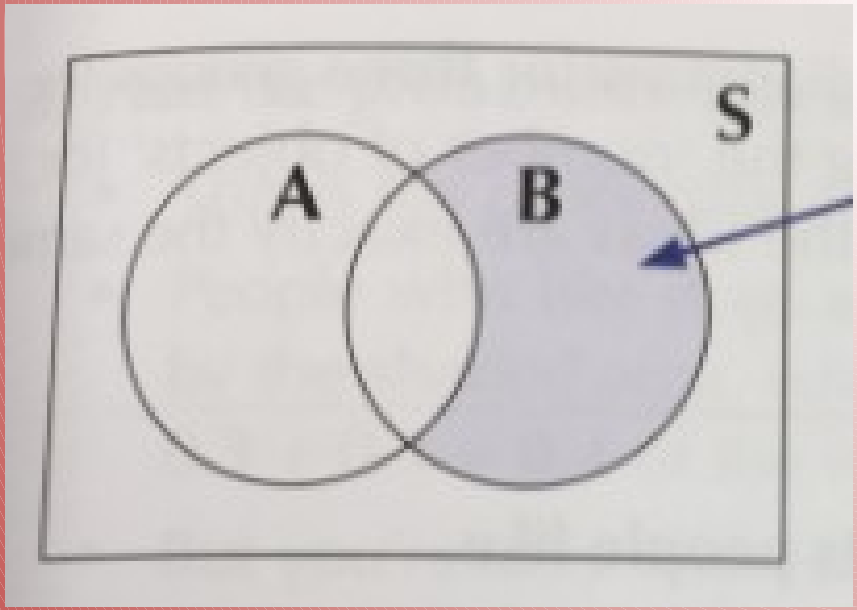


The shaded area represents all the outcomes corresponding to event A **not** happening.

Since event A must either happen or not happen, and since P(S) = 1:

10.1 Probability

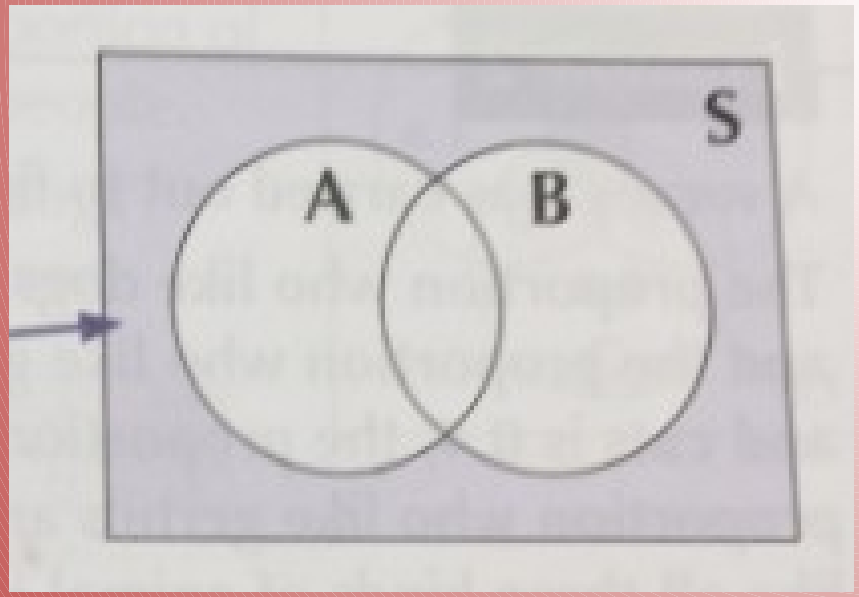
Venn Diagrams



The shaded area represents all the outcomes corresponding to event B happening and event A **not** happening.

10.1 Probability

Venn Diagrams



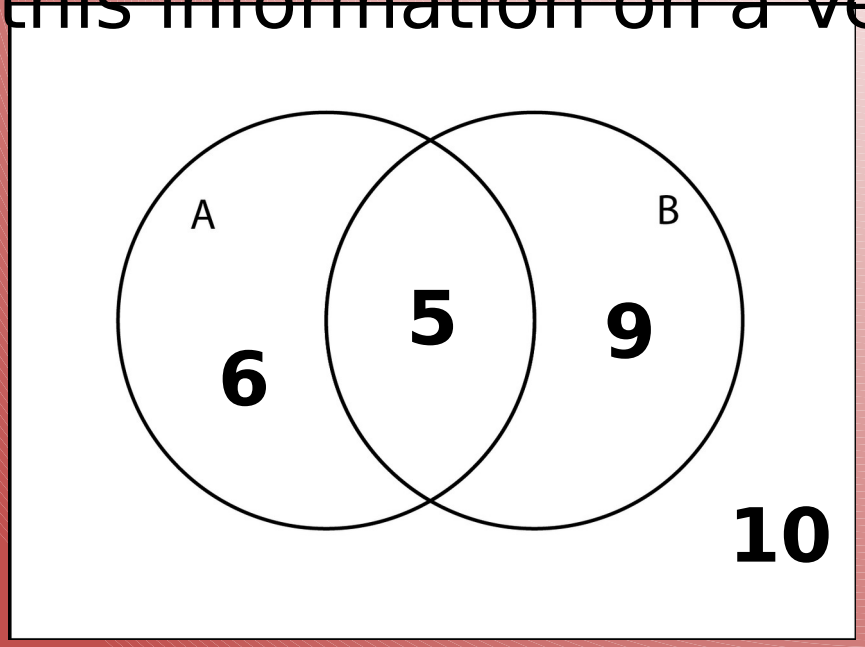
The shaded area represents all the outcomes corresponding to event A not happening and event B not happening.

or

10.1 Probability

Example 1

There are 30 pupils in a class. 14 of the pupils are girls and 11 of the pupils have brown hair. Of the pupils with brown hair, 6 are boys. Show this information on a Venn diagram.



A = Brown Hair

B = Girls

6 boys have brown hair

∴ 11 – 6 = 5 girls with BH

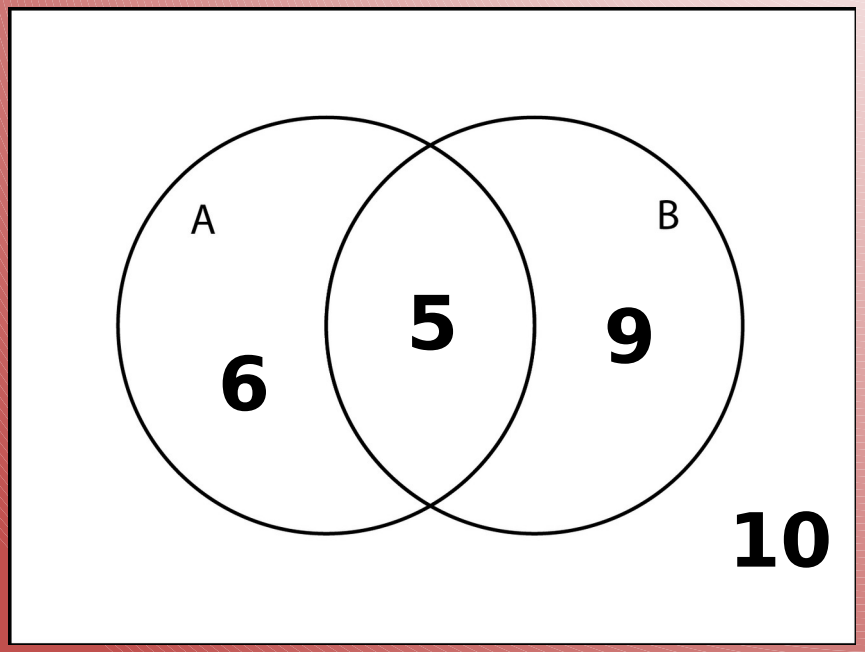
∴ 14 – 5 = 9 girls don't have BH

∴ 30 – 9 – 5 – 6 = 10 are

10.1 Probability

Example 1

A pupil is selected at random from the class. Find the probability that the pupil is a girl who doesn't have brown hair.



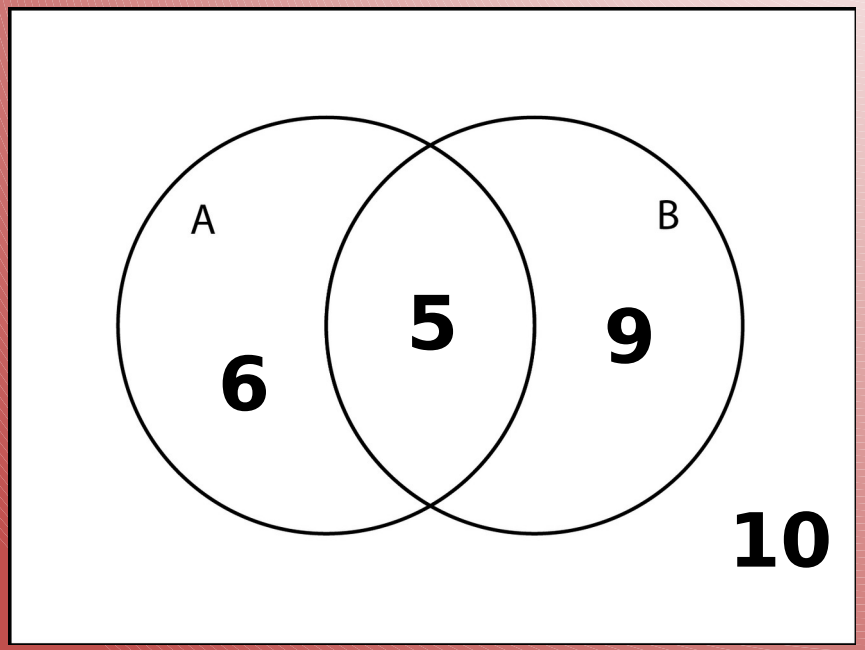
A = Brown Hair
B = Girls

9 girls do not have brown hair out of 30 pupils in the class:

10.1 Probability

Example 1

A girl is selected at random from the class. Find the probability that she has brown hair.



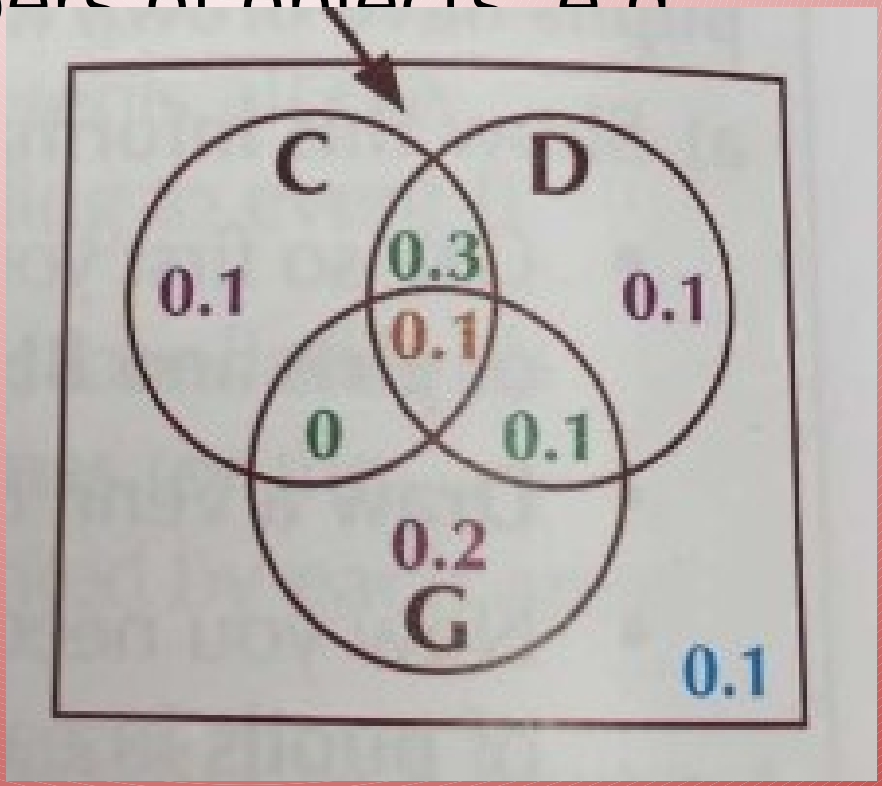
A = Brown Hair
B = Girls

5 girls have brown hair out of 14 girls in the class:

Watch out for the wording in the question as our denominator is

10.1 Probability

You also need to be able to draw and use Venn diagrams for three groups (or events). You may need to show proportions on the diagram rather than actual numbers of objects, e.g.



10.1 Probability

Example 2 – Using two-way tables

A shop sells balloons in three colours and three designs. The table shows the shop's sales of balloons for one day.

Each customer bought one balloon. Use the table to find the probability chosen customer:

a) Bought a plain red ballo

	Red	Blue	Silver	Total
Plain	11	21	13	45
Stars	43	29	48	120
Spots	45	20	20	85
Total	99	70	81	250

10.1 Probability

Example 2 – Using two-way tables

A shop sells balloons in three colours and three designs. The table shows the shop's sales of balloons for one day.

Each customer bought one balloon. Use the table to find the probability chosen customer:

b) Bought a balloon with s

	Red	Blue	Silver	Total
Plain	11	21	13	45
Stars	43	29	48	120
Spots	45	20	20	85
Total	99	70	81	250

10.1 Probability

Example 2 – Using two-way tables

A shop sells balloons in three colours and three designs. The table shows the shop's sales of balloons for one day.

Each customer bought one balloon. Use the table to find the probability chosen customer:

c) Bought a balloon that w
blue or had spots

	Red	Blue	Silver	Total
Plain	11	21	13	45
Stars	43	29	48	120
Spots	45	20	20	85
Total	99	70	81	250

10.1 Probability

You may need to show proportions on a two-way table.

Example 3

In any week, Carmel goes to a maximum of two evening classes. She goes to a dance class, to a knitting class, to both classes or to neither class.

The probability that she attends the dance class is 0.6.
The probability that she attends the knitting class is 0.3.
The probability that she attends both is 0.15.

10.1 Probability

Example 3

P(D) = 0.6
P(K) = 0.3
P(D and K) = 0.1

	D	D′	Total
K	0.15	**0.15**	0.30
K′	**0.45**	**0.25**	**0.70**
Total	0.60	**0.40**	1.00

10.1 Probability

Example 3

b) Find the probability that in a given week:
i) She attends at least one evening class

We need the probability that s
attends the danc
class, the knittin
class, or both:

P(D or K) =
0.45 + 0.15 + 0.
= 0.75

	D	D′	Total
K	0.15	**0.15**	0.30
K′	**0.45**	0.25	**0.70**
Total	0.60	**0.40**	1.00

10.1 Probability

Example 3

Exercise 2.1 from Sheet

b) Find the probability that in a given week:

ii. She attends exactly one evening class

We need the probability that she attends dance but not knitting OR knitting but not dance:

P(D and K') + P(K and

0.45 + 0.15 = **0.6**

	D	D′	Total
K	0.15	**0.15**	0.30
K′	**0.45**	**0.25**	**0.70**
Total	0.60	**0.40**	1.00